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Claims

[c1] An in-line system for forming a disposable hygienic absorbent product, comprising:
a bottom layer forming station having a first melt spinning die configured to discharge a first layer of filaments for forming a substantially liquid impermeable bottom layer;
a core forming station having a second melt spinning die configured to discharge a second layer of filaments for forming an absorbent core layer;
an acquisition layer forming station having a third melt spinning die configured to discharge a third layer of filaments for forming a fluid acquisition layer;
a top layer forming station having a fourth melt spinning die configured to discharge a fourth layer of filaments for forming a liquid permeable top layer;
said bottom layer forming station, core forming station, acquisition layer forming station, and top layer forming station arranged in-line to produce a layered construction comprising the bottom layer and top layer as outer layers and the absorbent core layer and fluid acquisition layer as inner layers positioned between the outer layers; and

a through air bonder configured to receive and thermally bond together the filaments comprising the bottom layer, core layer, acquisition layer, and top layer to form the disposable hygienic absorbent product.

[c2] The in-line system of claim 1, further comprising:
a first core containment layer station having a fifth melt spinning die configured to discharge a fifth layer of filaments for forming a first core containment layer;
a second core containment layer forming station having a sixth melt spinning die configured to discharge a sixth layer of filaments for forming a second core containment layer;
said first and second core containment layer stations arranged in-line with said core forming station to discharge the fifth and sixth layers of filaments on opposite sides of the absorbent core layer.

[c3] The in-line system of claim 1, further comprising:
a barrier layer forming station having a fifth melt spinning die configured to discharge a fifth layer of filaments between the bottom layer and the absorbent core layer to form a fluid barrier.

[c4] The in-line system of claim 1, wherein said first, second, third and fourth melt spinning dies further comprise multi-component filament spinning dies.

[c5] The in-line system of claim 1, wherein said first, second, third and fourth melt spinning dies each further comprise dies configured to simultaneously discharge monofilaments of different thermoplastic materials having different melt temperatures.

[c6] The in-line system of claim 1, wherein at least one of said first, second, third and fourth melt spinning dies further comprises a multi-component filament spinning die, and at least one of said first, second, third and fourth melt spinning dies further comprises a die configured to simultaneously discharge monofilaments of different thermoplastic materials having different melt temperatures.

[c7] The in-line system of claim 1, wherein said through air bonder further comprises:
first and second independently adjustable air moving devices configured to direct air through the layered construction in opposite directions.

[c8] The in-line system of claim 1, wherein said through air bonder is configured to direct air through the layered construction at different rates along the length of the layered construction.

[c9] The in-line system of claim 1, wherein said through air

bonder is configured to direct air through the layered construction at different rates along the width of the layered construction.

[c10] An in-line system for forming a disposable hygienic absorbent product, comprising:
a bottom layer forming station having a first melt spinning die configured to discharge a first layer of filaments for forming a substantially liquid impermeable bottom layer;
a first through air bonder configured to receive and thermally bond together the filaments comprising the bottom layer;
a core forming station having a second melt spinning die configured to discharge a second layer of filaments for forming an absorbent core layer;
an acquisition layer forming station having a third melt spinning die configured to discharge a third layer of filaments for forming a fluid acquisition layer;
a top layer forming station having a fourth melt spinning die configured to discharge a fourth layer of filaments for forming a liquid permeable top layer;
said core forming station, acquisition layer forming station, and top layer forming station arranged in-line to produce a layered construction comprising the fluid acquisition layer positioned between the absorbent core

layer and the top layer;

a second through air bonder configured to receive and thermally bond together the core layer, acquisition layer, and top layer into a composite structure, and

a third bonding station configured to receive and bond together the bottom layer and the composite structure.

[c11] The in-line system of claim 10, further comprising a melt processing station positioned downstream of said first through air bonder and configured to discharge a liquid barrier layer to form part of the bottom layer.

[c12] The in-line system of claim 11, wherein said third bonding station comprises at least one adhesive dispenser configured to discharge adhesive onto the liquid barrier layer to bond the liquid barrier layer to the composite structure.

[c13] The in-line system of claim 10, wherein said melt processing station further comprises a film extruder.

[c14] The in-line system of claim 10, wherein said first, second, third and fourth melt spinning dies further comprise multi-component filament spinning dies.

[c15] The in-line system of claim 10, wherein said first, second, third and fourth melt spinning dies each further comprise dies configured to simultaneously discharge

monofilaments of different thermoplastic materials having different melt temperatures.

[c16] The in-line system of claim 10, wherein at least one of said first, second, third and fourth melt spinning dies further comprises a multi-component filament spinning die, and at least one of said first, second, third and fourth melt spinning dies further comprises a die configured to simultaneously discharge monofilaments of different thermoplastic materials having different melt temperatures.

[c17] The in-line system of claim 10, wherein at least one of said first and second through air bonders further comprises:
first and second independently adjustable air moving devices.

[c18] The in-line system of claim 10, wherein said at least one through air bonder is configured to direct air through a corresponding one of the bottom layer or composite structure at different rates along the length thereof.

[c19] The in-line system of claim 10, wherein said at least one through air bonder is configured to direct air through a corresponding one of the bottom layer or composite structure at different rates along the width thereof.

[c20] A method of in-line manufacturing a disposable hygienic absorbent product, comprising:
melt spinning at least a first layer of filaments onto a collector to form a substantially liquid impermeable bottom layer;
melt spinning at least a second layer of filaments to form an absorbent core layer;
melt spinning at least a third layer of filaments to form a fluid acquisition layer;
melt spinning at least a fourth layer of filaments to form a liquid permeable top layer;
applying energy to at least some of the filaments in each layer sufficient to tackify the filaments; and
bonding the filaments in each layer together by directing air through each of the bottom layer, core layer, fluid acquisition layer, and top layer.

[c21] The method of claim 20, further comprising:
melt spinning at least a fifth layer of filaments to form a first core containment layer;
melt spinning at least a sixth layer of filaments to form a second core containment layer; and
encasing the absorbent core layer between the fifth and sixth layers prior to bonding the filaments in each layer together.

[c22] The method of claim 20, wherein the melt spinning steps each further comprise melt spinning at least two different thermoplastic materials having different melt temperatures with the relatively lower melt temperature material exposed, and the step of applying energy to the filaments further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c23] The method of claim 20, wherein the melt spinning steps each further comprise melt spinning at least two different thermoplastic materials having different melt temperatures as multi-component filaments with the relatively lower melt temperature material exposed, and the step of applying energy to the filaments further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c24] The method of claim 20, wherein the melt spinning steps each further comprise melt spinning at least two differ-

ent thermoplastic materials having different melt temperatures as monofilaments with a portion of the monofilaments formed from the relatively lower melt temperature material and another portion of the monofilaments formed from the relatively higher melt temperature material, and the step of applying energy to the filaments further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c25] The method of claim 20, wherein the step of bonding the filaments further comprises:
directing air at a first rate and in a first direction through the bottom layer, core layer, fluid acquisition layer and top layer; and
directing air at a second rate and in a second direction opposite to said first direction through the bottom layer, core layer, fluid acquisition layer and top layer.

[c26] The method of claim 25, wherein the first and second rates are different.

[c27] The method of claim 20, wherein the step of bonding the filaments further comprises:

directing air through the bottom layer, core layer, fluid acquisition layer and top layer at different rates along the lengths thereof.

[c28] The method of claim 20, wherein the step of bonding the filaments further comprises:
directing air through the bottom layer, core layer, fluid acquisition layer and top layer at different rates along the widths thereof.

[c29] The method of claim 20, further comprising:
adding a non-fiberized absorbent material to said core layer.

[c30] A method of in-line manufacturing a disposable hygienic absorbent product, comprising:
melt spinning at least a first layer of filaments onto a collector to form a substantially liquid impermeable bottom layer;
applying energy to at least a first portion of the filaments in the first layer sufficient to tackify the first portion of filaments;
drawing air through the bottom layer to bond at least the first portion of filaments together;
melt spinning at least a second layer of filaments to form an absorbent core layer;
melt spinning at least a third layer of filaments to form a

fluid acquisition layer;
melt spinning at least a fourth layer of filaments to form a liquid permeable top layer;
applying energy to at least a second portion of the filaments in the second, third and fourth layers sufficient to tackify the second portion of filaments;
drawing air through the core layer, fluid acquisition layer, and top layer to bond the filaments of the core layer, fluid acquisition layer, and the top layer together into a composite structure; and
bonding the bottom layer to the composite structure.

[c31] The method of claim 30, wherein the melt spinning steps each further comprise melt spinning at least two different thermoplastic materials having different melt temperatures with the relatively lower melt temperature material exposed, and the steps of applying energy each further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c32] The method of claim 30, wherein the melt spinning steps each further comprise melt spinning at least two different thermoplastic materials having different melt tem-

peratures as multi-component filaments with the relatively lower melt temperature material exposed, and the steps of applying energy each further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c33] The method of claim 30, wherein the melt spinning steps each further comprise melt spinning at least two different thermoplastic materials having different melt temperatures as monofilaments with a portion of the monofilaments formed from the relatively lower melt temperature material and another portion of the monofilaments formed from the relatively higher melt temperature material, and the steps of applying energy each further comprises:
heating the relatively lower melt temperature material to a temperature sufficient to tackify and bond with other intersecting filaments while maintaining the temperature of the relatively higher melt temperature material below its melt temperature.

[c34] The method of claim 30, further comprising:
extruding a fluid impermeable film onto the bottom layer.